David Staack

Assistant Professor · Texas A&M University
Mechanical Engineering Department
3123 TAMU, College Station, TX 77843
(979)-845-4063 · dstaack@tamu.edu

EDUCATION

Drexel University, *Philadelphia, PA*
PhD, Mechanical Engineering, September 2004 - December 2008

Princeton University, *Princeton, NJ*
Mechanical and Aerospace Engineering, January 2001 - August 2004

University of Virginia, *Charlottesville, VA*
MS/BS, Aerospace Engineering, September 1995 - January 2001

EXPERIENCE

Assistant Professor, *Texas A&M University, College Station, TX, January 2009 - Present*
Research Areas and Applications: Non-thermal plasmas, Micro- and Nano-Scale plasmas, Plasma Enhanced Materials Processing and Synthesis, Plasma Enhanced Fuel Conversion and Combustion, Plasma Sterilization, Plasma Medicine, Electric Propulsion for Spacecraft, Laser and Spectroscopic Diagnostics.
Courses Taught: Thermodynamics (MEEN:315), Fluid Dynamics (MEEN:344), Interdisciplinary Design II (ENGR:402), Thermo-Fluids Analysis and Design (MEEN:421), Advanced Thermodynamics (MEEN:615), Plasma Engineering and Applications (MEEN/NUEN: 417), Microscale Thermodynamics (MEEN:631)
Teaching Interests: Fluid Dynamics, Thermodynamics, Statistical Thermodynamics, Experimental Methods, Spectroscopic Diagnostics and Lasers, Plasmas Processing, Plasma Physics, Spacecraft Propulsion.

Graduate Research Assistant, *Drexel University, Philadelphia, PA, 2004-2008*
Advisors: Dr. Bakhtier Farouk, Dr. Alexander Fridman
Dissertation Title: Characterization and Stabilization of Atmospheric Pressure DC Microplasmas and their Application to Thin Film Deposition.
Research: Scaling, control, and stabilization of microplasma and nanoplasma discharges in atmospheric pressure gases and liquids. Optical Emission Spectroscopy, Plasma Enhanced Chemical Vapor Deposition, Raman and FTIR characterization, Carbon Nanotube Probes, Plasma-Biological Interactions.

Adjunct Instructor, *Drexel University Goodwin College, Philadelphia, PA, 2006-2007*
Courses Taught: Thermal and Fluid Science Laboratory (MEM 311)

Graduate Research Assistant, *Princeton University, Princeton NJ, 2000-2004*
Advisors: Dr. Nathaniel Fisch, Dr. Yevgeny Raitses
Research: Plasma Wall Interactions in Hall Thrusters, Spacecraft Propulsion, Probe Based Plasma Diagnostics.

Graduate Research Assistant, *University of Virginia, Charlottesville VA, 1998-2000*
Advisor: Dr. James C. McDaniel

Thesis Title: Experimental Study of Interacting Rarefied and Continuum Flow Using Planar Laser- Induced Iodine Fluorescence
Research: Hypersonic Wind Tunnel, Rarefied Gas Dynamics, Rarefied-Continuum Interactions, Spacecraft Reentry.

Undergraduate Research Assistant, *University of Virginia, Charlottesville, VA and Carnegie Mellon University, Pittsburg, PA, 1996-1998*
Advisor: Dr. Randy Pausch
Research: Development of Alice 3D graphics software for programming virtual reality environments.

ACHIEVEMENTS

3M Non-Tenured Faculty Award
TEES Select Young Faculty Award, 2012
NSF Career Award, 2011
Research Paper Featured in Nature, 2008
Koerner Foundation Fellowship, 2006
NSF-IGERT Fellowship in Nanotechnology, 2005
Outstanding Teacher Assistant Award, 2005
NASA Graduate Student Researchers Program (GSRP) Fellowship, 1999
Virginia Space Grant Consortium Aerospace Graduate Research Fellowship, 1999
Sigma-Gamma-Tau Outstanding Aerospace Graduate Award, 1999
AIAA Student Conference First-Place Paper Winner, 1999

RESEARCH FUNDING

Funding Summary: As grant participant: $1,517k, As PI: $1,450k, Investigator Share: $1,032k. Major grants are:

1. "CAREER: Micro- and Nano- Scale Plasma Discharges in High Density Fluids", NSF, PI: David Staack, 6/2011-6/2016, $400,000.
2. "Plasma Processing Living Tissues", 3M, PI: David Staack, 4/2013-3/2016, $45,000
3. "High Carrier Density, Fast Switching Microscale Plasmas Enabled by Exploitation of Plasma Instabilities and High Pressures", DARPA / US Army ARO, PI: David Staack, Co-PI: Molly Gentleman, Co-PI: Tanvir Farouk, 8/15/11- 11/14/14, $698,690.
4. "Plasma Discharge Treatment of Oil Samples", Chevron, PI: David Staack, 11/10 – 12/13, $295,782.
5. "Dynamic Stall Flow Control Through the Use of a Novel Plasma Based Actuator Technology", Lynntech (SBIR), NASA (prime), subcontract $ 33,959.
6. "Investigation of Plasma-Science behind Aerisa Air Cleaning Solutions", Performance Edge Partners, PI: David Staack, 4/11-9/11, $20,000.

PATENTS, DISCLOSURES AND COPYRIGHT

1. United States Patent no. 8,388,618, issued March 5, 2013, "Control of Mucus Membrane Bleeding with Cold Plasma", G Fridman, A Fridman, A Gutsol, G Friedman, D Staack, RJ Hamilton.
2. Patent Application WO/2010/107722, "Tubular Floating Electrode Dielectric Barrier Discharge for Applications in Sterilization and Tissue Bonding", G Fridman, A Fridman, A Gutsol, G Friedman, D Staack (2010).
3. Patent Application WO/2010/022160, "Nanoscale Discharges in Liquids" D Staack, A Gutsol, A Fridman, Y Gogotsi, G. Friedman (2010).

4. Patent Application S/N 61/511,297, Filed: July 25, 2012, Title: Methods and Systems For Plasma Processing Hydrocarbon Liquids, Inventors: David A. Staack and Robert P. Geiger
5. Patent Application S/N 61/471,766, Filed April 5, 2012, Title: Plasma Treatment and Plasma Enhanced Chemical Vapor Deposition onto Temperature Sensitive Biological Materials, Inventors: David Staack, Tsung-Chan Tsai.
6. Disclosure TAMUS-3315, "Use of Non-Thermal Plasma for Seed and Soil Treatment", YK Jo, D Staack, D Gross (2011).

JOURNAL PUBLICATIONS

1. T.-C. Tsai, J. Cho, K. McIntyre, Y.-K. Jo, D. Staack "Polymer film deposition on agar using a dielectic barrier discharge jet and its bacterial growth inhibition", Applied Physics Letters, Vol. 101, Is. 7, 074107, 2012.
2. T.C. Tsai, D. Staack "Characteristics of Precursor-Dependent Breakdown in Helium Dielectric Barrier Discharge Jet", IEEE Transactions on Plasma Science, online early view, 2012
3. R. Geiger and D. Staack, "Analysis of solid products formed in atmospheric non-thermal carbon monoxide plasma", J. Phys. D: Appl. Phys. 44 274005, 2011
4. T.C. Tsai, D. Staack "Low-temperature Polymer Deposition in Ambient Air Using a Floating-electrode Dielectric Barrier Discharge Jet", Plasma Processes and Polymers, Vol. 8, Is. 6, p. 523–534, 2011.
5. D. Staack, B. Farouk, A. Gutsol, A. Fridman, "Stabilization of the ionization overheating thermal instability in atmospheric pressure microplasmas," Journal of Applied Physics , vol.106, no.1, p.013303-7, 2009.
6. D. Antao, D. Staack, A. Fridman, B. Farouk, "Atmospheric pressure dc corona discharges: operating regimes and potential applications", Plasma Sources Sci. Technol. Vol. 18 no.3, p. 035016 (11pp), 2009.
7. S. Bhattacharyya, D. Staack, E. Vitol, R. Singhal, A. Fridman, G. Friedman, Y. and Gogotsi, "Localized Synthesis of Metal Nanoparticles Using Nanoscale Corona Discharge in Aqueous Solutions", Advanced Materials, 21: 4039–4044, 2009.
8. M. Cooper, G. Fridman, D. Staack et al,."Decontamination of Surfaces from Extremophile Organisms Using Non-thermal Atmospheric Pressure Plasmas," IEEE Transactions on Plasma Science, vol. 37, no. 6, pp. 866 - 871, 2009.
9. H. Ayan, D. Staack, G. Fridman et al., "Application of Nanosecond-Pulsed Dielectric Barrier Discharge on Biological Tissues with Non-uniform Surfaces for Plasma Medicine", Journal of Physics D: Applied Physics, vol. 42, p. 125202 (5pp), 2009.
10. H. Ayan, G. Fridman, D. Staack, *et al.*, "Heating Effect of Dielectric Barrier Discharges for Direct Medical Treatment", *IEEE Transactions on Plasma Science*, vol. 37, no. 1, p. 113-120, 2009.
11. D. Staack, A. Fridman, A. Gutsol *et al.*, "Nanoscale Corona Discharge in Liquids, Enabling Nanosecond Optical Emission Spectroscopy," *Angewandte Chemie-International Edition,* vol. 47, no. 42, p. 8020-8024, 2008.
12. D. Staack, B. Farouk, A. Gutsol *et al.*, "DC normal glow discharges in atmospheric pressure atomic and molecular gases," *Plasma Sources Science & Technology,* vol. 17, no. 2, 2008.
13. A. Wilson, D. Staack, T. Farouk *et al.*, "Self-rotating dc atmospheric-pressure discharge over a water-surface electrode: regimes of operation," *Plasma Sources Science & Technology,* vol. 17, no. 4, 2008.
14. Y. Raitses, D. Staack, and N. J. Fisch, "Controlling the plasma potential distribution in segmented-electrode Hall thruster," *IEEE Transactions on Plasma Science,* vol. 36, no. 4, p. 1202-1203, 2008.
15. D. Staack, B. Farouk, A. F. Gutsol *et al.*, "Spatially resolved temperature measurements of atmospheric-pressure normal glow microplasmas in air," *IEEE Transactions on Plasma Science,* vol. 35, no. 5, p. 1448-1455, 2007.
16. T. Farouk, B. Farouk, D. Staack *et al.*, "Modeling of direct current micro-plasma discharges in atmospheric pressure hydrogen," *Plasma Sources Science & Technology,* vol. 16, no. 3, p. 619-634, 2007.
17. D. Staack, B. Farouk, A. F. Gutsol *et al.*, "Spectroscopic studies and rotational and vibrational temperature measurements of atmospheric pressure normal glow plasma discharges in air," *Plasma Sources Science & Technology,* vol. 15, no. 4, p. 818-827, 2006.
18. Y. Raitses, D. Staack, A. Dunaevsky *et al.*, "Operation of a segmented Hall thruster with low-sputtering carbon-velvet electrodes," *Journal of Applied Physics,* vol. 99, no. 3, 2006.
19. T. Farouk, B. Farouk, D. Staack *et al.*, "Simulation of dc atmospheric pressure argon micro glow-discharge," *Plasma Sources Science & Technology,* vol. 15, no. 4, p. 676-688, 2006.

20. Y. Raitses, A. Smirnov, D. Staack *et al.*, "Measurements of secondary electron emission effects in the Hall thruster discharge," *Physics of Plasmas,* vol. 13, no. 1, 2006.
21. D. Staack, B. Farouk, A. Gutsol *et al.*, "Characterization of a dc atmospheric pressure normal glow discharge," *Plasma Sources Science & Technology,* vol. 14, no. 4, p. 700-711, 2005.
22. Y. Raitses, D. Staack, A. Smirnov *et al.*, "Space charge saturated sheath regime and electron temperature saturation in Hall thrusters," *Physics of Plasmas,* vol. 12, no. 7, 2005.
23. Y. Raitses, D. Staack, M. Keidar *et al.*, "Electron-wall interaction in Hall thrusters," *Physics of Plasmas,* vol. 12, no. 5, 2005.
24. D. Staack, Y. Raitses, and N. J. Fisch, "Temperature gradient in Hall thrusters," *Applied Physics Letters,* vol. 84, no. 16, p. 3028-3030, 2004.
25. D. Staack, Y. Raitses, and N. J. Fisch, "Shielded electrostatic probe for nonperturbing plasma measurements in Hall thrusters," *Review of Scientific Instruments,* vol. 75, no. 2, p. 393-399, 2004.
26. Y. Raitses, M. Keidar, D. Staack *et al.*, "Effects of segmented electrode in Hall current plasma thrusters," *Journal of Applied Physics,* vol. 92, no. 9, p. 4906-4911, 2002.

SELECTED CONFERENCE PUBLICATIONS

1. Staack D, "Non-thermal microscale plasma in liquids for elemental detection and other applications", 38th Meeting of the Federation of Analytical Chemistry and Spectroscopy Societies, Oct 3-7 2011, Reno NV.
2. Staack D, "Non-thermal plasma reforming of liquid phase hydrocarbons using low energy nanosecond pulsed discharges", Workshop on Atmospheric Pressure Weakly Ionized Plasmas for Energy Technologies, Flow Control, and Materials Processing, Princeton, Aug 23-24 2011, Princeton NJ.
3. Staack D, "Microplasma Research at the Texas A&M Plasma Engineering and Diagnostics Laboratory", Workshop on Microplasma Science and Technology, August 10-13 2011, Hoboken NJ.
4. Geiger R, Gaalema G, Staack D, "Discharges Between Charged Particles in Oil", 20th International Symposium on Plasma Chemistry, July 24-29, 2011, Philadelphia PA, USA.
5. Tsai TC, Cho J, Jo YK, and Staack D, "Sterilization and Inhibition of Bacteria Growth by Polymer Film Barriers Deposited Using a Floating-Electrode Dielectric Barrier Discharge Plasma Jet in Ambient Environment Conditions" , 20th International Symposium on Plasma Chemistry, July 24-29, 2011, Philadelphia PA, USA.
6. Staack D, "Invited: Microscale plasma discharges in liquids and high pressure gases", 20th International Symposium on Plasma Chemistry, July 24-29, 2011, Philadelphia PA, USA.
7. Geiger R, Ghimire S, Kawashima R, Staack D, "Thermodynamics of Microplasma Initiation in Liquids", 38th IEEE International Conference on Plasma Science, June 26-20, 2011, Chicago IL.
8. Tsai TC, and Staack D, "Characteristics of Impurity-Dependent Breakdown in Helium Dielectric Barrier Discharge Jets", 38th IEEE International Conference on Plasma Science, June 26-20, 2011, Chicago IL.
9. Staack D, "(Invited) Microscale Plasma Discharges in Aqueous Solutions: New Technique for Localized Synthesis of Nanoparticles", Meet. Abstr. - Electrochem. Soc. 1001, 1128 (2010)
10. Chitre A, Staack D, "Scaling of normal glow discharge towards 1µm: Microplasma discharges in high pressure gases," 2010 Abstracts IEEE International Conference on Plasma Science, vol., no., pp.1, 20-24 June 2010
11. Geiger R, Staack D, "Reforming and fixation of carbon oxides in atmospheric pressure non-thermal CO/CO2 plasmas," 2010 Abstracts IEEE International Conference on Plasma Science, vol., no., pp.1, 20-24 June 2010
12. Parimi S, Staack D, "Effective plasma discharge reforming of methane using warm non-equilibrium discharges," 2010 Abstracts IEEE International Conference on Plasma Science, vol., no., pp.1, 20-24 June 2010
13. Tsia, T, Staack D, "Plasma-enhanced polymer deposition in ambient environment conditions using dielectric barrier discharge plasma jet," 2010 Abstracts IEEE International Conference on Plasma Science, vol., no., pp.1, 20-24 June 2010

14. Staack D, Fridman G, Farouk B, Friedman G, Gutsol A, Fridman A, “Tubular floating electrode dielectric barrier discharge for applications in sterilization and tissue bonding”, 1st International Conference on Plasma Medicine, Corpus Christi TX, Oct 15-18, 2007.
15. Staack D, Farouk B, Gutsol A, Fridman A, “Thin film deposition using atmospheric pressure microplasma”, 34th IEEE International Conference on Plasma Science, Albuquerque NM, June 17-22, 2007.
16. Staack D, Farouk B, Gutsol A, Fridman A, “Atmospheric pressure RF microplasma characterization”, 18th International Symposium on plasma chemistry, Kyoto Japan, August 26-31, 2007.
17. Staack D, Farouk B, Gutsol A, Fridman A, “Rotational and Vibrational Temperature Measurements of Atmospheric Pressure Normal Glow Plasma Discharges in Air, Nitrogen, Argon, and Helium,” proceeding of the 3rd International Workshop on Microplasmas, Greifswald, Germany, May 9-11, 2006, p. 102.
18. Staack D, Farouk B, Gutsol A, Fridman A, “Atmospheric Pressure Normal Glow DC Microplasma in Air,” proceedings of the 17th International Symposium on Plasma Chemistry, Toronto, Canada, August 7-12, 2005, ab. 94.
19. Staack D, Raitses R, and Fisch N J, “Control of Acceleration Region in Hall Thrusters,” the 28th International Electric Propulsion Conference, Toulouse, France, March 17-21 2003, IEPC paper 2003-0273.
20. Staack D, Raitses Y, Fisch N J, “Investigations of probe induced perturbations in a Hall thruster,” 38th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, Indianapolis, IN, July 7-10, 2002, AIAA Paper 2002-4109.
21. McDaniel J C, Glass C, Staack D, Miller C, “Experimental and computational comparison of an under-expanded jet flowfield,” AIAA Aerospace Sciences Meeting & Exhibit, 40th, Reno, NV, Jan. 14-17, 2002, AIAA Paper 2002-0305.
22. Raitses Y, Staack D and Fisch N J, “Measurements of Plasma Potential Distribution in Segmented Electrode Hall Thruster,” 27th International Electric Propulsion Conference, Pasadena, CA, October 2001, IEPC Paper-01-060.
23. Raitses Y, Staack D, Smirnov A, Litvak A, Dorf A, Graves T, Fisch N J, “Studies of non-conventional configuration closed electron drift thrusters,” AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 37th, Salt Lake City, UT, July 8-11, 2001, AIAA Paper 2001-3776.
24. Staack D, McDaniel J C, Glass C E, and Miller C, “Experimental study of interacting rarefied and continuum flows,” AIAA Thermophysics Conference, 35th, Anaheim, CA, June 11-14, 2001, AIAA Paper 2001-2762.
25. Staack D and Delvecchio T, “The Design Building and Calibration of a Hypersonic Wind Tunnel,” AIAA, Aerospace Sciences Meeting and Exhibit, 38th, Reno, NV, Jan. 10-13, 2000, AIAA Paper 2000-0004. [Winner AIAA Regional Student Conference First-Place Paper Winner]
26. Pierce J, Audia S, Burnette T, Christiansen K, Cosgrove D, Conway M, Hinckley K, Monkaitis K, Patten J, Shochet J, Staack D, Stearns B, Sturgill C, Williams G, Pausch R, “Alice: Easy to Use Interactive 3D Graphics,” ACM Symposium on User Interface Software and Technology 1997, .p 77-78.

INVITED LECTURES AT CONFERENCES AND SEMINARS

1. D. Staack, “Microplasma in Liquids”, University of Texas at Austin, Aerospace Engineering, Feb. 28, 2013.
2. D. Staack, “Microplasmas in Liquids”, Baylor University, Physics Department, Feb. 22, 2012.
3. D. Staack, “Invited: Microscale plasma discharges in liquids and high pressure gases”, International Symposium on Plasma Chemistry, July 24-29, 2011, Philadelphia PA, USA.
4. D. Staack, “(Invited) Microscale Plasma Discharges in Aqueous Solutions: New Technique for Localized Synthesis of Nanoparticles”, 217th Electrochemical Society (ECS) Meeting - Vancouver, Canada, Apr. 26, 2010.

5. D. Staack "Micro-Scale Plasma Discharges in High Density Fluids", Invited Seminar, Case Western Reserve University, Electrical Engineering Department, Nov. 19, 2010.

Professional Services and Activities

Reviewer for IEEE Transactions on Plasma Science, Physics of Plasmas, J. Applied Physics, plasma Processes and polymers and other journals.
Member: AIAA, ASME, APS, IEEE
Proposal Reviewer: NSF.

Organization of Conferences and Sessions

1. International Plasma Chemistry Society, ISPC-20: Plasma in Liquids Session Chair, appointed, July 2011.
2. 2010 IEEE-International Conference on Plasma Science, ICOPS: Microplasma Session Chair, appointed, June 2010.
3. Plasmas and Nanomaterials, Session Organizer, Gordon-Kenan Research Seminar Plasma Processing Science, Colby-Sawyer College in New London NH United States, July 10th, 2010.

Students Advised

Doctoral Students

1. William Pollard, "Microscale Plasma Actuators", current student.
2. Tsung-Chan 'Cliff' Tsai , "Plasma Enhanced Film Deposition on Biological Substrates at Ambient Conditions", Phd 2012.
3. Michael Martin, "Ion Fluxes in VASIMIR Backfield", current student - coadvisor.
4. Peng Xiao, "Bubble Formation during pulsed microplasmas inliquids", current student.
5. Robert Geiger, "Non-thermal plasmas in liquids for applications in hydrocarbon fuel reforming using" current student.

M.S. Students

1. Sreekar Parami, "Study of Methane Reforming in Warm Non-Equilibrium Plasma Discharges", Texas A&M College Station, MS 2010
2. Aditya Chitre, "Microplasma Discharges in High Pressure Gases – Scaling towards the sub-micron Regime", Texas A&M College Station, MS 2010
3. Frans Ebershon, "MHD model for high current density thruster plume", Texas A&M, MS 2012, co-advisor.
4. Robert Geiger, "Investigation on the solid products formed in a glow discharge in carbon monoxide" MS 2012.
5. Dani Wakim, "Nanosecond switching microplasma", current student.
6. Pinjia Ming, "Low Temperature Plasma Processing of Gaseous Fuels", current student.